Induction of Pluripotent Stem Cell-Derived Pacemaking Cells

Grant Award Details

Induction of Pluripotent Stem Cell-Derived Pacemaking Cells

Grant Type: Basic Biology IV

Grant Number: RB4-05764

Project Objective: The goal is to increase the yield of pacemaking cells that can be differentiated from human induced pluripotent stem cells (hiPSCs). There is an emphasis on Ca^{2+} signaling pathways via activation of small conductance Ca^{2+}-activated K^+ channels (SKs).

Investigator:

Name:	Deborah Lieu
Institution:	University of California, Davis
Type:	PI

Disease Focus: Heart Disease

Human Stem Cell Use: iPS Cell

Award Value: $1,333,689

Status: Closed

Progress Reports

Reporting Period: Year 1

View Report

Reporting Period: Year 2

View Report

Reporting Period: Year 3

View Report

Reporting Period: NCE (Year 4)

View Report

Grant Application Details

Application Title: Induction of Pluripotent Stem Cell-Derived Pacemaking Cells

Public Abstract: Currently, over 350,000 patients per year with abnormal heart rhythm receive electronic pacemakers to restore their normal heart beat. Electronic pacemakers do not respond to the need for changing heart rate in situations such as exercise and have limited battery life, which can be resolved with biopacemakers. In this proposed project, we will examine methods that improve the generation of pacemaking cells from human induced pluripotent stem cells as candidates for biopacemaker.

Statement of Benefit to California: This proposal aims to generate pacemaking cells through facilitated differentiation from human induced pluripotent stem cells that may serve as biopacemakers. Over 350,000 patients a year in the U.S. require the implantation of an electronic pacemaker to restore their heart rhythm, with more than 3 million patients that are dependent on this device. At the cost of $58K per pacemaker implantation, the healthcare burden is greater than $20 billion a year. However, the cost associated with these electronic devices does not end with surgery for implantation. These devices require a battery change every 5 to 10 years that involve another surgical procedure. With California being the most populated state, this can be very costly to the Californians. It also does not give the patients the quality of life by having to endure repeated surgeries. The possibility of biopacemaker that requires no future battery replacements and other advantages such as physiological adaptation to the active state of the patient make biopacemakers a truly desirable alternative to electronic devices. Moreover, one in 20,000 infants or preemies with congenital sinoatrial node dysfunction are also inappropriate candidates to receive electronic pacemakers because they are physically too small and require a proportional increase in the length of pacing leads with their significant growth rate. Therefore, there is a great need for biopacemakers that may overcome the deficiencies of electronic devices.